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ABSTRACT

A study examined the assumption that writing is a way to learn by examining the relative effects of writing and studying as learning aids. The study also explored the role of individual differences in an effort to identify features of the writing process that may influence what students learn through writing. The experiment used think-aloud protocols and comprehension testing in a mixed experimental design. Forty college freshmen each performed a writing task and a study task, in each case working with a 1,200-word reading passage which served as the to-be-learned material. The writing task led to lower scores than the study task on two of four comprehension measures. Writing and studying processes were analyzed along seven dimensions via the protocol transcripts. Stepwise regression analyses revealed several significant relationships between process features and comprehension. Results suggest that process features such as planning and audience awareness are important variables in the relationship between writing and learning. (Two figures and two tables of data are included.) (Author/KEH)

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Center for the Study of Writing



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STRATEGIC DIFFERENCES IN COMPOSING: CONSEQUENCES FOR LEARNING THROUGH WRITING

Ann M. Penrose

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ABSTRACT

This study examines the assumption that writing is a way to learn by examining the relative effects of writing and studying as learning aids. The study also explores the role of individual differences in an effort to identify features of the writing process that may influence what students learn through writing. The experiment uses think-aloud protocols and comprehension testing in a mixed experimental design. Forty college freshmen each performed a writing task and a study task, in each case working with a 1200-word reading passage which served as the to-be-learned material. The writing task led to lower scores than the study task on two of four comprehension measures. Writing and studying processes were analyzed along seven dimensions via the protocol transcripts. Stepwise regression analyses reveal several significant relationships between process features and comprehension. Results suggest that process features such as planning and audience awareness are important variables in the relationship between writing and learning.

Strategic Differences in Composing: Consequences for Learning through Writing

By

Ann M. Penrose
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Though intuitively appealing and currently quite popular, the assumption that writing is a way to learn has yet to be fully examined. Applebee (1984) and other reviewers have noted the scarcity of research on this issue and have argued the need for more careful study of the complex relationships between writing and learning (cf. Weiss & Walters, 1979; Newell, 1984). We need such research--not because we need to be convinced that writing is a good thing to do, but because we want to be able to make intelligent decisions about what to do with it. We need to know, for example, what kinds of writing tasks are most effective for accomplishing various learning goals, and which learning goals are best achieved through writing. We need to learn how to help students engage successfully in the "writing-to-learn" tasks we develop. And we need to know whether writing is an effective learning tool for all students.

Recent studies have begun to examine these complex issues, with mixed results. Copeland (1985), working with sixth graders, found writing led to higher scores on both a transfer measure and a measure of factual recall, when compared with three non-writing activities (answering multiple choice questions, directed rereading and a control activity). On the other hand, Newell (1986) found no advantage of essay writing over notetaking or answering study questions on eleventh graders' ability to recall content or relationship units or to answer application questions. He did, however, find that essay writing led to significant gains in passage specific knowledge, as did Langer (1986). But in a later study, Langer and Applebee (1987) found that essay writing led to lower topic knowledge gains.

Further findings by Langer and Applebee (1987), Marshall (1987), and Durst (1987) offer a possible explanation for these apparently conflicting results. These studies demonstrate that different kinds of writing tasks (e.g., summary vs. analytic writing) encourage different kinds of cognitive operations and thus engage students in different kinds of "learning." Such findings suggest that what students learn through writing depends to some extent on the nature of the writing task they are assigned.

We know from experience and from research, however, that students will approach writing tasks in varying ways, and learning models caution us to consider *what students do* with a given task rather than focusing exclusively on what we assume the task requires (cf. Bransford, 1979; Doyle, 1983). In the studies mentioned above, for example, Langer and Applebee (1987) and Copeland (1985) observed relationships between the content of individual students' essays and their performance on comprehension measures, indicating that students' choice of what to include in their essays influenced what they learned. Writers will vary along other dimensions as well--in planning behaviors, level of audience awareness, organizational strategies, and so forth. The present study is motivated by the assumption that differences in these and other writing process variables may influence what students learn through writing on a given occasion. The study seeks to identify process variables that play particularly critical roles in the relationship between writing and learning.

In short, the study approaches the writing-as-a-way-to-learn issue by examining writing in a framework used for studying other types of learning processes (Bransford, 1979; adapted from Jenkins, 1978). The Bransford (1979) framework proposes four factors to consider in describing learning situations: characteristics of the learner, the processes or activities the learner engages in, the nature of the material to be learned, and the criterial task. The present study examines writing as a learning activity by describing these factors and examining interactions among them.

METHOD

Similar to the studies cited above, this experiment compares writing with "studying" and uses reading selections as the to-be-learned material.

To overview, "writing" in this experiment refers to writing an extended essay about the to-be-learned material, a 1200-word reading selection. "Studying" is broadly defined to include whatever strategies subjects chose to employ to help them prepare for a test on the to-be-learned material. "Learning" is operationally defined by scores on four types of passage-specific comprehension items.

Design

The study uses think-aloud protocols and comprehension testing in a mixed experimental design. Within-subjects variables are task (writing and studying) and topic (A and B). Task/topic order is a between-subjects factor. Counterbalancing tasks and topics resulted in four conditions, to which subjects were randomly assigned. The design is summarized in Figure 1.

<u>Prior Knowledge Screening</u>	<u>Cond</u>	<u>N</u>	<u>First Task</u>	<u>Second Task</u>	<u>Delayed Recall</u>
	1	10	Write A Test A	Study B Test B	Tests A & B
	2	10	Write B Test B	Study A Test A	Tests A & B
	3	10	Study A Test A	Write B Test B	Tests A & B
	4	10	Study B Test B	Write A Test A	Tests A & B

Figure 1. Experimental Design

Dependent measures are passage-specific comprehension scores (immediate and delayed), paper quality ratings, and time on task. Classification variables are writing process features and study process features. SAT-Verbal score is an independent variable.

Subjects & Procedures

Forty college freshmen took part in the study. Subjects were screened for prior knowledge of the two source text topics, using an adaptation of Langer's (1980) prior knowledge measure. Those who demonstrated high knowledge on either topic were excluded from the study.

Each subject attended two experimental sessions: in one session, the subject read a 1200-word academic text and was instructed to "write a report" on the text material; in the other, he or she read another 1200-word text and was instructed to "study for a test" on the material, using whatever study strategies they thought appropriate (pen and paper were provided). Subjects had one hour for each task and gave think-aloud protocols as they worked in both conditions.

After each task, subjects answered comprehension items in four categories (see below). Thirty-one of the 40 subjects (others unavailable) were contacted by phone 8-9 weeks after their second sessions and asked to attend a third session in which they took both comprehension tests again as a delayed recall measure.

Texts

Two texts were pilot tested for use in this study. To increase generalizability, the readings were chosen from different domains, one in the sciences and one in the humanities, and are of different readability levels. Both could be classified as "informative" essays (as opposed to persuasive or argumentative), and both are approximately 1200 words long.

Text A is about hurricanes. It includes a description of how hurricanes form and a discussion of storm control efforts and tracking techniques. This reading was adapted from an article in *Smithsonian* (Whipple, 1982). The Fry Readability Scale places this text at about the 12th grade level.

Text B is about paternalism. It includes an extended definition of the concept and a discussion of cultural systems which operate on this principle. This text was excerpted from a college textbook on critical reading and writing (Kaufer, Geisler, & Neuwirth, in press). The Fry Readability Scale places this text at the 17+ level.

Comprehension Tests

A set of 20 comprehension questions was developed and pilot tested for each of the two source texts. Questions were developed in four categories, based on a taxonomy of comprehension types described by Rosenshine (1980).¹

1. *Simple Recall*: items requiring the recall of facts explicitly stated in the source text.
2. *Complex Recall*: items requiring the recall of two or more related facts from different parts of the source text.
3. *Macrostructure*: items which require an understanding of the hierarchy of ideas conveyed by the text, as in recognizing the main ideas.
4. *Application*: items which require the reader to apply information of types 1, 2, or 3; to draw conclusions based on information gathered or inferred from the text.

ANALYSIS

Comprehension Tests

The hurricane test includes 14 short answer items and 6 multiple choice items; the paternalism test has 16 short answer and 4 multiple choice. Multiple choice items were scored by the experimenter. The experimenter also scored the short answer items, developing rating criteria based on the range of responses each item elicited. A second rater used these criteria to score a subset (1/4) of the tests on each short answer item. Average inter-rater reliability over the 14 short answer hurricane items was $r=.81$. Reliability over the 16 short answer paternalism items was $r=.82$. The two raters discussed those scores on which they had differed and agreed on a single score for each.

Written Products

The 40 draft essays which subjects wrote during the writing task were read by two raters, both experienced writing teachers. The raters were instructed to assess each paper for "writing quality," using a holistic scale of 1 (low) to 4 (high). Inter-rater reliability was .54 on the hurricane essays ($n=20$; $p<.05$) and .50 on the paternalism essays ($n=20$; $p<.05$). Collapsed over both topics, reliability was .50 ($n=40$; $p<.05$). After these initial ratings, the two raters discussed the five papers on which they had disagreed by more than one point and came to agreement within one point. The two scores were summed to derive a single "Paper Quality" score for each subject.

Writing and Studying Protocols

The process features analyzed in the writing and studying protocols were developed from the protocols themselves. In a first reading of the transcripts, the experimenter looked for dimensions of variation and arrived at a tentative set of features and rating categories which were refined in subsequent readings. A second rater used these categories to analyze a subset (10%) of the protocols. In analyzing for each feature, raters used all available data from each subject: protocol transcript, source text markings, notes and written draft. One feature was dropped from the analysis due to poor reliability; some categories within features were collapsed at this point because finer distinctions could not be reliably replicated by the second rater.

Seven process dimensions proved robust enough for inclusion in the final analyses. Protocol transcripts from the both the writing and the studying task were analyzed on four of these dimensions: reading strategies, underlining, note-taking, and author awareness. Three additional dimensions were used in analyzing protocols from the writing task only: planning, writing approach and audience awareness. The seven process features are summarized in Figure 2 and are described below.

Reading. The clearest dimension of variation among reading strategies observed in the protocols was in the level of text structure that readers attended to--that is, whether readers attended to the hierarchy or macrostructure of the text (as when they commented on a paragraph's topic or on a move that the author was making) or seem confined to the microstructure (as when they read and reread the text straight through with no comment on topic or structure). This feature was coded using two categories:

1. Little or no macro-level commenting.
2. Frequent macro-level commenting. For example, subject says "OK, this is giving the definition" or identifies a superordinate category by writing "tracking techniques" in the margin.

Underlining. Underlining behaviors also provided evidence of the subjects' level of engagement with the material in the source text. Coding on this feature focused on the *kind* of material underlined:

1. No underlining.
2. Facts & figures (micro-level focus): Subject either (a) underlines dates, names or other details, as opposed to topic sentences or key phrases, or (b) underlines most of the text, evidencing little selection at this stage.
3. Idea-based underlining (macro-level focus): Subject underlines key points, unifying concepts.

The first four dimensions below were used in analyzing protocols from both the writing and the studying task.

Reading:

1. Little or no macro-level commenting
2. Frequent macro-level comments

Underlining:

1. No underlining
2. Facts & figures
3. Idea-based underlining

Note-taking:

1. No notes
2. Facts & figures
3. Idea-based notes

Author Awareness:

1. Low evidence
2. Some evidence
3. High evidence

The dimensions below were used in analyzing protocols from the writing task only.

Planning:

1. No separate planning episode
2. Minimal planning
3. Planning episode

Writing:

1. Sentence-by-sentence paraphrase
2. Idea-based writing

Audience Awareness:

1. Low evidence
2. High evidence

Figure 2. Summary of Protocol Coding Dimensions

Note-taking. Distinctions along this dimension were similar to those used to describe underlining strategies:

1. No notes.
2. Facts & figures: Subject either (a) lists names and dates or (b) copies virtually everything from the source text into her notes, evidencing little selection.
3. Idea-based notes: Subject writes down key points, unifying concepts.

Author Awareness. Another dimension of variation apparent in the protocols was whether or not subjects demonstrated an awareness of an author behind the source text. This feature was coded strictly on the basis of how often the subject referred explicitly to an author, usually as "he" or "they." (References to the source text as "it" or "in there" were not counted as evidence of author awareness.)

1. Low evidence: No explicit author mentions.
2. Some evidence: One or two clear author mentions.
3. High evidence: Several clear author mentions.

The three dimensions described below applied to the writing protocols only.

Planning. Though the original goal was to code for the type of planning writers did, the most distinctive dimension of variation observed in the data was whether or not subjects planned at all. This feature was coded on a scale from 1 to 3 indicating amount of planning:

1. No separate planning episode.
2. Minimal planning: For example, the writer identifies the main issues that he or she should cover but does not spend time working with them aside from writing the draft. Or the subject may pause periodically during writing to do a little local planning, but does not engage in extensive global planning.
3. Separate planning episode: Subject takes a separate pass through the material before starting the draft, outlining or listing topics to be covered. This episode usually but does not necessarily involve written notes, lists or outlines.

Writing Approach. Subjects' approaches to the writing task were distinguished primarily on the basis of how closely they adhered to the language and structure of the source text. This feature was coded using two categories.

1. Sentence-by-sentence paraphrase: Close copy or paraphrase of the source text.
2. Idea-based writing: Writer presents the ideas rather than the language of the source text. Subject (a) writes a loose section-by-section paraphrase, working from notes or from memory with occasional references to source text or (b) transforms the source text material by adding substantive connections and/or restructuring.

Audience Awareness. In an effort to gauge the extent to which writers in this study were sensitive to rhetorical constraints in this writing situation, writing protocols were examined for evidence that the writer was writing for an audience. Evidence for these assessments included explicit audience mentions in the protocol transcripts (e.g. "they won't understand that, I'll have to explain it"), as well as evidence from the written products, particularly the opening and closing segments (some writers set a context for the reader, though they may not talk about doing this; e.g., one student begins his conclusion with "Of course, one can see the urgency in trying to gain data on hurricanes..."). Two categories were used:

1. Low evidence: Few or no indications of audience awareness.
2. High evidence: Many audience awareness indicators.

RESULTS

Effects of Task

The first phase of analysis examined the effect of task (writing vs. studying) on comprehension scores. Difference scores were computed for each subject on each of the four comprehension measures (e.g., percent correct on simple recall items on the paternalism test was subtracted from percent correct in this category on the hurricane test). Two-way ANOVAs were run on these difference scores to test for effects of Task, Topic, and Task X Topic interactions.

These analyses reveal a significant effect of task on two of the four comprehension types: the study task led to higher scores than the writing task on simple recall ($F(1,36)=5.13, p<.03$) and application items ($F(1,36)=5.23, p<.03$), as well as on a composite measure, "Total Comprehension," which collapses over the four comprehension types ($F(1,36)=7.05, p<.01$). The effect of task on simple recall was consistent across topics, but a task by topic interaction was observed on the application measure ($F(1,36)=6.84, p<.01$). On these items, which required subjects to use information from the readings in new contexts, the study task led to higher scores than writing on the hurricane text, a text which contains a great deal of concrete, factual information. However, no significant difference was observed on the paternalism text, which operates at a more abstract level. In other words, when the criterial task was to apply information to new contexts, writing an essay about a body of factual material was less effective than directly studying that material, but the writing task "didn't hurt" students' ability to recall and apply more abstract material.

These analyses reveal no main effects for order, and no significant effects of task, topic or order were observed on the delayed measures. A separate two-way ANOVA does, however, reveal a significant effect of task on time-on-task ($F(1,36)=68.05, p<.001$). Subjects spent an average of 35% more time on the writing task than on the studying task (54 vs. 40 minutes). This analysis reveals no significant effect of topic on time-on-task.

Process Features as Comprehension Predictors

Stepwise regression analyses were used to examine relationships between process features and comprehension scores. Separate stepwise analyses were performed on each of the four comprehension measures and on the composite "Total Comprehension," for both the immediate and the delayed tests. In each analysis,

process dimensions were entered as predictor variables (seven process variables in the writing task analyses; four for the study task); Topic and SAT-Verbal scores were entered as covariates. In addition, because some relationships may be obscured in the stepwise analyses due to correlations between process features, the features were also examined individually in separate regression analyses, using the process features as independent predictors.

As we might expect, SAT-Verbal score was the most consistent predictor of comprehension scores in this experiment. In the writing task, this variable predicts scores on the immediate tests in every category except Complex Recall, though it had no predictive power on the delayed tests. In the study task, SAT-V predicts scores on the immediate tests in every category except Simple Recall, and predicts scores in two categories on the delayed tests, Complex Recall and Total Comprehension. SAT-V was also the strongest overall predictor, having been entered on the first or second step in each of the analyses in which it proved significant.

However, after SAT is accounted for, several writing and study process features also have predictive value. The other significant relationships revealed in the stepwise regression analyses are summarized in Tables 1 and 2 and are discussed below.

<u>Writing Process Feature</u>		<u>Comprehension Type</u>	<u>F</u>	<u>df</u>	<u>p</u>
Reading predicts		Macrostructure, delayed	6.67	1,21	.025
Underlining	"	Macrostructure, delayed (-)	5.23	1,29	.05
Note-taking	"	Complex Recall	5.56	1,33	.05
Author Awareness		-----			
Planning	"	Macrostructure, delayed (-)	11.22	1,27	.01
		Total Comp., delayed (-)	4.50	1,27	.05
Writing Approach		-----			
Audience Awareness	"	Simple Recall (-)	7.45	1,32	.025
		Complex Recall (-)	4.66	1,34	.05
		Total Comp. (-)	4.29	1,32	.05

Table 1. Summary of Regression Analyses: Significant Relationships between Writing Process Features and Comprehension Scores

Study Process Feature		Comprehension Type	F	df	p
Reading predicts		-----			
Underlining	"	Complex Recall, delayed (-)	9.05	1,26	.01
Note-taking		-----			
Author Awareness	"	Complex Recall, delayed (-)	6.16	1,25	.025
		Total Comp. (-)	6.39	1,33	.025

Table 2. Summary of Regression Analyses: Significant Relationships between Study Process Features and Comprehension Scores

In the writing task, the *Reading* feature predicts scores on Macrostructure items on the delayed tests, indicating that subjects who made frequent macro-level comments while reading were more likely to remember the structure and purpose of the texts they wrote about than were students who had evidenced little awareness of text structure while reading. This feature had no predictive value on the study task.

Underlining is the only feature with predictive value on both the writing and studying tasks. In the writing task, Underlining predicts scores on Macrostructure items on the delayed tests, but in an unexpected direction: these results indicate that students who did not underline at all when reading-to-write were more likely to remember the structure and purpose of the source text than were students who had used underlining. In the study task, Underlining predicts Complex Recall scores on the delayed tests, again in the "negative" direction. However, this feature correlated "positively" with Paper Quality scores ($F(1,38)=6.60$, $p<.025$); that is, students who had used underlining tended to receive higher quality ratings for their essays than students who had not used underlining. These results indicate that underlining, even idea-based underlining, was not a very helpful learning strategy in this experimental context, though it did lead to "better writing" as defined by the holistic rating scheme.

In the writing task, *Note-Taking* predicts Complex Recall scores on the immediate test, indicating that students who took idea-based notes during the writing process were better able (than students who had taken no notes or fact-and-figure notes) to answer questions which required them to recall and connect information from different parts of the text they had written about. This feature had no predictive value on the study task.

The *Author Awareness* feature had no predictive value on the writing task. In the study task, Author Awareness predicts Complex Recall scores on the delayed test and Total Comprehension scores on the immediate test. Both of these analyses predict in the "negative" (i.e. unexpected) direction: subjects who evidenced high awareness of "an author behind the text" tended to have more difficulty recalling and connecting information from the text than students who had evidenced little or no author awareness while reading.

In the writing task, *Planning* predicts Macrostructure scores and Total Comprehension scores on the delayed tests. Again, the direction of these predictions seems counterintuitive: subjects who spent time planning their essays before writing were *less* likely to recall the structure and purpose of the text they had written about than were subjects who had done little or no planning. (This feature, and the two below, were used in analyzing the writing transcripts only.)

Writing Approach did not predict comprehension scores but did predict Paper Quality scores ($F(1,34)=5.04, p<.05$). Students who took an idea-based approach to the writing task tended to receive higher quality ratings for their essays than students who wrote sentence-by-sentence paraphrases of the source texts.

Audience Awareness predicts Simple Recall, Complex Recall, and Total Comprehension scores on the immediate tests. All three analyses reflect negative relationships between audience awareness and comprehension: subjects evidencing high audience awareness were *less* likely to remember factual information from the source text than were subjects who evidenced little or no awareness of audience.

In sum, this exploratory study examined a total of 117 potentially predictive relationships: seven writing process features were examined for predictive value on five immediate comprehension measures, five delayed comprehension measures and one paper quality measure; four study process features were examined for predictive value on five immediate comprehension measures and five delayed measures. Five or six significant results would be expected by chance among this number of analyses. The thirteen significant results reported above must be viewed in this light.

DISCUSSION

The only index of general intelligence or academic ability included in this design is the SAT-Verbal score, and it is not surprising that these scores correlate positively and consistently with reading comprehension. Of more interest, though, is the fact that after thus roughly controlling for academic ability, features of the writing and studying processes still have predictive power. The process variables provide information about what students actually did with the writing task--about how they worked with and thought about the source text material and the constraints of the writing situation. While these are crude measures of behavior and cognitive activity, they give us some insight into the complex relationship between writing and learning by suggesting some intervening variables. When we advocate writing as a way to learn in all disciplines, we need to think about the support skills that students may need to master in order to use writing effectively in this capacity.

The present results suggest, for example, that what a student learns through writing may in part be a function of his or her reading or note-taking strategies. The following profiles illustrate contrasting approaches to the essay writing task and corresponding differences in comprehension. Both students wrote on the topic of paternalism.

Jack works closely and systematically with the source text. After reading through the text quickly, he goes back for a second pass, taking extensive notes. Jack's notes are verbatim excerpts from the source text, with connectives and modifying phrases omitted. The following transformation is typical:

Source Text:

In cultures where there is no strong, centralized government to define and protect the rights of common individuals, however, "parental concern" is often a vital bond holding together the culture's major social and economic relationships.

JACK'S NOTES:

In cultures no strong, centralized government, "parental concern" often a vital bond.

Jack spends quite a bit of time in this note-taking phase, proceeding laboriously through the text in this sentence-by-sentence manner. He writes his essay by converting these notes into complete sentences, in many cases reinserting the connectives he had dropped out earlier. The sentence above is partially restored in this phase:

JACK'S ESSAY:

In cultures where there is no strong, centralized government, "parental concern" is often a vital bond.

It is interesting to note here that although Jack's essay closely resembles the source text, he has not intentionally plagiarized. He did not set out to copy the source text, and is probably not even aware that his reconstruction is so accurate. Jack worked very hard at this task, staying past the one hour time limit (63 minutes).

Ruth takes a very different approach to the writing task and uses just forty minutes of the allotted hour. In contrast to Jack's painstaking sentence-by-sentence translation, Ruth jots down key words as she reads:

RUTH'S NOTES (in their entirety):

Paternalism -- control in fatherly.

In cultures, no the rich are left to support.

Cultural take on features of a parent/child relationship

 Boss control the worker. Taking of the weaker.

 Less power dependent of the powerful.

 Difference.

 No intimate contact.

 Paternalist benefits for worker.

Paternalist will keep workers no matter what.

 Advantages.

By having paternalism country is more unified.

Ruth's last note, that paternalism may have a unifying effect, is not a source text idea but represents Ruth's own reflection on the material. The essay that she writes includes many such reflections. After a quick review of the source text material in the first two paragraphs, Ruth uses the second half of her short essay for a discussion of her own view of paternalism:

RUTH'S ESSAY (second half):

The only advantage I can see for having a economic paternalistic system in a country is the country will be unified. This unification is great for the government, but how does it affect the workers? These workers may not have the same opportunity to succeed in their goals due to ignorance or the always present put down from the employer/government, so they are stuck in this type of relationship.

The paternalistic system may be good for countries like Japan, but I'm glad this type of system is not in the U.S. It is wrong for a person to keep another person 'a child' in the sense of word. An employer can show the same type of affection or caring a parent shows for their child, but they can also let that child reach for their goals.

As these profiles suggest, Jack and Ruth learned quite different things through this writing experience. Surprisingly, they scored similarly on Simple Recall questions (Jack, 57% correct and Ruth, 43%) and on Application items (Jack, 38%; Ruth, 31%). But striking comprehension differences were revealed in the Macrostructure and Complex Recall categories. Jack, who had worked so closely with the source text, was easily able to answer questions about the macrostructure of that text (73%), whereas Ruth, who had extracted key ideas and created a structure of her own, demonstrated little knowledge of the source text structure at recall (27%). On the other hand, Ruth was far better able to answer Complex Recall questions, which required her to recall and connect information from different parts of the text (78%). As we might expect, Jack had great difficulty with these questions (33%); his sentence-by-sentence approach had perhaps prevented him from making such connections.

Which of these approaches is the "right" one? The answer depends on which kind of learning we want students to engage in. None of the strategies observed in this study can be labeled "good" or "bad"; they accomplish different goals. As the Bransford (1979) learning framework suggests, we cannot talk about the efficacy of writing and studying strategies without considering the nature of the criterial task.

The question of the criterial task becomes particularly important when we examine the results on the paper quality measure. The present findings suggest that the skills or strategies a student needs in order to achieve "good learning" may not be the same strategies that lead to "good writing." Indeed, in this study, Underlining is the only process feature which significantly predicts both comprehension scores and paper quality ratings, and this feature predicts in opposite directions: students who used underlining as a learning strategy performed poorly on delayed macrostructure questions; but they wrote better essays than students who hadn't used underlining. The goal of writing a good essay may conflict with other kinds of learning goals.

This potential conflict is perhaps best illustrated by the fact that Planning and Audience Awareness, features which receive strong emphasis in process-based writing curricula, both correlated negatively with comprehension in this study. Results on the Planning feature indicate that subjects who engaged in more extensive and sophisticated planning were *less* likely to recall the structure and purpose of the text they had written about than were subjects who had done little or no planning. This finding suggests that students who did plan may have been creating their own structures rather than imitating the structure of the source text, a hypothesis which is supported by the fact that ratings on the Planning feature varied positively with Writing Approach ($r(\phi) = .32, p < .05$); that is, writers of idea-based essays tended to plan more than paraphrasers. As the

example of Ruth suggests, the idea-based writers may not have remembered the structure of the source text because they had not worked within it; they had learned other things.

Similarly, writers who thought quite a bit about their audience were *less* likely to remember factual information from the source text than those who evidenced little or no awareness of audience. Presumably, when we ask students to "write with an audience in mind" we want them to make connections, set a context, and otherwise elaborate on the material to make it relevant and coherent to a reader; we want them to go beyond the facts. Results on the Audience Awareness feature suggest that this is just what writers who think seriously about the audience are doing. In fact, they may be focusing on high-level, unifying concepts at the expense of learning individual facts. Ned, another student writing on the paternalism topic, is a case in point. Ned evidences high audience awareness, as his first two paragraphs illustrate. (Note: Alcoa and Ford are not mentioned in the source text.)

NED'S ESSAY (opening paragraphs):

Paternalism is a word that most people are familiar with, however, they are really only familiar with one definition. They would describe paternalism as the relationship between a father and child. They would go on to give an example, probably from their household or somebody they know household, where the father is the highest figure and has the last say in any situation. Though this is a very general term it does complete the task of defining the word.

With this definition in mind, I would like to give the other important definition that many of us don't even know. Imagine a company, such as Alcoa or Ford, where there are many people working for the company. We will be very specific and only describe those people that have low-level jobs, such as the factory workers. These people, many who have probably worked for the company for a while, have a dependence upon that company. They work for the company, receive their paychecks weekly, and with this money, they are able to feed their family, pay the bills and hopefully have a little extra to spend on leisure or save. This worker is in a very similar position to that of a child in the above genetic paternalism relationship. He has a very large dependence upon a fatherly figure, which in this case is the owner or board of trustees of the company. He depends on these people to keep his welfare alive. Thus one can see that there is a so called paternalistic relationship in the economic world.

Ned is clearly writing to an audience here. He begins with his readers' preconceptions about paternalism and relates the new concept (economic paternalism) to this starting point, creating a familiar context for the reader with the examples of Alcoa and Ford. Ned is doing the kinds of things that writing texts typically seek to encourage. This approach did not, however, help Ned learn isolated facts from the source text; he answered only 29% of the Simple Recall items correctly.

In sum, such strategies as planning and thinking about the audience may lead to success or failure, depending on the learning goals we have in mind and (recalling the task-by-topic interaction on the application measure) on the nature of the material to be learned. Certainly this study examines a limited set of learning goals, focusing primarily on "fact-gathering" types of learning--the retention of facts, concepts and relationships from source texts. It's important to recall, though, that these results reveal no advantage of writing over studying on these conventional comprehension measures. In fact, the writing task led to significantly lower scores on the Simple Recall and

Application measures, despite the fact that students typically spent far more time writing than studying. These findings indicate that writing may not be the best choice of learning activity when our goal is to help students gather information from a reading selection.

Evidence from the protocol transcripts, however, suggests that these comprehension measures do not tell the whole story. The writing task seems to have provided some students an opportunity for critical reflection and elaboration. Ruth's evaluative reflections and Ned's careful analysis, for example, demonstrate levels of engagement with the topic that the comprehension measures could not capture. It is important to note that much, perhaps most, of what writing can do for us as a learning tool is not easily described or assessed. Equally important, though, is the amount of variability in the process data: not all writers recognize writing as an opportunity to engage in higher level learning, and not all are able to take advantage of this opportunity.

To conclude, our arguments for writing across the curriculum are often interpreted as claiming that writing can help students learn the basic subject matter of a discipline, but this may not be the case -- if by "basic subject matter" we mean the simple facts and concepts that novices in a discipline must master before they can begin to think critically about *issues* in the discipline. Writing may be more helpful in achieving higher level learning goals, after students have become familiar with the basic information and concepts of the discipline. Writing seems better suited for the purpose of critically examining information than for gathering it. The results reported here should caution us to think carefully about what we expect of writing, particularly when we advocate its use as a learning device in classrooms across the disciplines.

More immediately, these results point to a need to clarify our own goals in designing "writing-to-learn" tasks. When we choose to assign writing as a learning activity, we need to let our students know not just the kind of writing we want them to do but the kind of learning we want them to engage in. The decisions writers make in writing have consequences for their learning. We need to give students information that will allow them to set goals and choose strategies that are appropriate to the learning task at hand.

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FOOTNOTE

¹ Rosenshine's third category, Complex Inferential Skills, was subdivided into Macrostructure and Application categories in the present study.

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